Preserving or Poisoning: A Case of Dried-Beans from Nigeria

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Abstract

Beans (Vigna unguiculata) are commonly known as the cowpea, black-eyed pea, catjang, china-pea, cow-gram or southern-peas that were mainly grown in the tropics and subtropics regions. Globally, beans are great source of protein for human, and are found in curry dishes, cooked with rice, in desserts or as paste. This is a popular legume grown in Nigeria which were mainly dried and stored for either local consumption or traded and exported to various countries around the world, especially the European Union. Nigeria was among the leading beans exporting nation of the world. Since 2013, the EU has placed temporary import suspension on dried-beans originating from Nigeria due to the discovery of higher pesticides residue found in them (between 0.03mg/kg and 4.6mg/kg). This study assesses the key techniques used in preserving dried-beans in Nigeria. Based on the qualitative nature of the data involved, the study employed survey research design that depend on in-depth interview with open ended questions and personal observations. This study discovered that high illiteracy among the dried-beans merchants and storekeepers lead to direct application of various toxic pesticide in high doses onto the dried-beans with a sole intension of protection from pest. The study finally recommends the provision modern grain storing facilities.

Keywords: *Dried-beans, Storage, Pesticides, Nigeria, Preserving*

I. Introduction

Beans *(Vigna unguiculata)* are grain legumes which are rich, water soluble vitamins and less expensive sources of dietary proteins. Beans are commonly known as the cowpea, black-eyed pea or beans, catjang, chinapeas, cowgram or southern peas, and grown in tropics and subtropics used as food for human as well as for animal (Bliss, 1972). They vary in colour, shape, size and eye-patterns. These are predominantly hot-weather crop (preferring a temperature of 20 to 35^0C). The seed ranges from 2 to12 mm (in length) with globular shape. The seed coat may be rough, smooth, or wrinkled and exist in various colours such as white, black, green, brown, red or purple (Taiwo, 1998). Hence, beans are always dried before taking to market for sales. Beans or cowpea is a valuable source of protein, vitamins (thiamine and niacin), mineral (P, K, Ca, Mg) and dietary fibre. Beans contain about 25% protein, and also contained low in anti-nutritional factors (Taiwo, 1998). It constitutes more than 50% of all legumes consumed (Philip and McWatter, 1991).

Among various types of legumes, beans is the most widely grown, traded and distributed food commodity in Nigeria (Campos-Vega and Oomar, 2010), and also exported to various countries around the world. Due to its health benefits, Beans products can lower serum cholesterol levels (Uebersax *et al.,* 1991) and combining it with high-fibre diets is well tolerated and has no side effects. Moreover, it is considered as good source of both soluble and insoluble dietary fibre with high health benefits. These characteristics and the like makes beans ideally suitable in helping consumers to meet the dietary goals of reducing fat intake and increasing the intake of starch and other complex carbohydrates (Huges, 1991).

For almost two decades, Nigeria remained the largest producer of dried-beans in the world with almost 70% of the world total production (FAO, 1992). Being a hot-weathered crop it can be grown over a wide range of soil types, cowpea remained suitable for a large portion of the northern Nigeria. Even though, cowpea is grown in southern part of the country, the Sudan Savannah zone in the extreme northern parts of the country remained the major producers of cowpea in Nigeria. Various studies report that good pest control and prompt planting (May/June in Northern region) mainly result to good production of cowpea (Taiwo, 1998).

Beans are usually inter-planted with other crops such as millet, sorghum and maize by subsistence farmers, while farmers with large acreage practise mono cropping (Ige, 1978). Traditionally, beans are harvested as pods from the plant by hand-picking on alternate days (Taiwo, 1998). These pods are usually thrashed and allowed it moisture to dry before storing, given that beans required to be handled under minimum degree of mechanical damage (Uebersax *et al*., 1991). Hence, both beans production and storage are greatly threatened with severe insect pests in Nigeria. These insect pests damaged the crop at various stages of development which will consequently affect its total production. During storing, these crops are extremely vulnerable to a wide range of viral, fungal and bacterial diseases. It is estimated that about 30,000 tonnes per year of cowpea seeds are damaged due to bruchids (a popular pest) during storage (Keri, 2009). These damages caused by insects through making of holes in the seeds lead to loss of weight of about 10% (Ejiga, 1979). With absence of modern grain storage facilities, the merchants and storekeepers were only left with of using synthetically made pesticides.

Pesticides are poisons specifically produced to get rid of pests and other related insects (Banjo *et al.*, 2010). Pesticides are important agricultural management tool; they increase yields and increase protection against insects at pre-harvest, post-harvest as well as during storage. It is also has continued to be the bedrock of agriculture in modern times because of its unquantifiable benefits one of which include enhancement of shelf life of stored agricultural products (Olabode *et al.*, 2011). According to a study by Ogunjimi and Farinde (2012), the use of pesticides in Nigeria has been on the increase since their introduction in early 1950s. However, the demand for pesticides has continued to increase in the face of Nigeria's growing human population and increased agricultural activities (Ogunjimi and Farinde, 2012).

These synthetic pesticides are mainly applied before preserving or storage which serve as a preventatives measure against fungal and insects infections on the dried-beans. The primary aim of this study is to explore the motive behind this high level of toxics presence in dried-beans originating from Nigeria. In order to achieve this, the study proposed the following objectives: to examine the basic techniques used in preservation of dried-beans in local markets of Nigeria and to assess the different types of pesticides used in preservation of dried-beans as well as their level of compliances to synthetic products user manuals.

II. Materials and Methods

Based on the qualitative nature of the data involved in this study, the study utilized intensive interview as a tool for data collection. This study selected the Potiskum grain market as a sample. This grain market is one of the biggest grain market where agricultural products mainly grains are traded for both local as well as international market due to its centric location geographically as well as heavy duty transportation advantage. A survey was conducted using in-depth interview with open-ended questions to stimulate discussion. A total number of 77 people were interviewed from September to November, 2017. The respondents included are the local farmers (sellers), merchants, storekeepers, labourers and traders within the market. The data generated were carefully coded, and carefully analyzed using content analysis in order to understand and depicted the current scenario regarding dried-beans preservation and storing in local markets in Nigeria.

3. Study Area

The study was carried out in Potiskum grain market (Yobe State) North Eastern region of Nigeria. Potiskum is a local government and also the economic hub of Yobe State. It is located on the A3 highway at $11^0$43'N and $11^0$04'E. Potiskum is situated centrally in a strategic location connecting Jos via Bauchi, Gombe via Ashaka, Kano via Azare, Nguri via Gashua and Maiduguri via Damaturu. Potiskum has an area of 559 square kilometers and has a population of 205,876 according to 2006 census.

4. Results and Discussions

Beans are legumes which are widely grown in North-Eastern Nigeria. There are different varieties of beans found across Nigeria (about 32 species according to FAO (1992)). These legumes were mainly dried after harvested and packaged in bags for either local consumption or sells for export. In Africa, bean production mainly suffered significant damages by insect pests (Abate, 1996). According Abate, bean pests can be classified into five broad categories according to the plant growth stage or plant part they primarily attack seedlings, foliage, flowers, pods, and stored seeds. Abate (1996) further reported that stored dried-beans suffer heavy losses in terms of both quality and quantity in Africa.

The dried-beans are popular staple food eaten within Nigeria as well as overseas. This is due to their numerous health benefits and nutritional values. It is a great source of healthy protein when compared to all other high protein foods in the country. In Nigeria, dried-beans is the 4th most consumed after cassava, yam, and rice, and as well one of the most popular and staple foods in Africa (FAO, 1992). Brown and black-eyed cowpeas are the most abundantly cultivated by majority of farmers in northern parts of country, for instance, Borno, Gombe, Kano, Sokoto, Yobe and Zamfara State (Otitodun *et al*., 2012).

The market price of dried-beans is very volatile in Nigeria; it varies from month to month, from one location to another, and also varies across different types. Hosfield (1991) reported that the most preferred dried-beans is mainly determined by a number of factors, such as; free from infestation, its colour and appearance, ease of preparation, wholesomeness, mouth-feel as well as texture. Moreover, the price of cowpea fluctuates considerably from year to year and also depends on some local factors and the availability of local supplies to its major market.

4.1 The Embargo on Export Products from Nigeria

Worldwide, dried-beans are found in curry dishes, cooked with rice, in desserts or as paste. Even in the International Harmonized Commodity Description and Coding System, dried-beans are registered and traded under specific statistical numbers (Morner *et al*., 2002). Just like other developing countries, EU member offer a relatively stable market for Nigerian dried-beans with various opportunities considering the reliable volumes that can be produced within the country. Beans are not commonly grown in Europe, except for small quantities in Croatia and surrounding countries, and the EU members have annual supply of this product of almost 500,000 tonnes (WHO, 2013). The EU members' beans demands' depend mostly on dried-beans originating from developing nations like Nigeria and the likes (Otitodun *et al*., 2012).

January 2013, the European Commission placed a temporary suspension of imports of dried-beans from Nigeria for one year which was further extended until 30 June 2019. This is as a result of discovering presence of higher pesticide residues, which can cause acute neurotoxicity, found in dried-beans originating in Nigeria. The details of the temporary suspension are outlined in regulation (EU) 2015/943 as amended by Regulation 2016/874. The ban will stay in effect until June 30th 2016 by which time the EU hoped the exporters of dried-beans from Nigeria would have adhered to regulations and minimum acceptable residue

level. Most of the rejected beans from EU member countries were found to contain between 0.03mg per kilogramme and 4.6mg/kg of dichlorvos pesticide. Despite, the minimum acceptable residue level is 0.01mg/kg. However, The Nation Newspaper on Sunday, April 5th 2015 further reported that about a total of 42 food items produced in Nigeria were rejected by United Kingdom (UK) for quality defects and other toxicities issues. It was discovered that the dried beans rejected by the EU are not safe for consumptions by standard. The synthetic chemical used in storage of the beans did not break down before the handlers put it out for exportation. Ideally, depending on the chemical formulation, the beans should have been left in storage for a period of 3-4 months before presenting it to consumers. But if an organic fertiliser and organic storage chemical is used in the planting and storage of beans, it will be suitable for consumption and exportation immediately as no pesticide residue is left.

Consequently, the EU ban initially was expected to expire by June, 2017, but was extended due to the observed non-compliances to the pesticides and other related chemicals minimum acceptable residue level of 0.01mg/kg. This and the likes lead to the collaboration between the EU and some competent authorities in Nigeria which are currently developing appropriate risk-management measures. Economically, this EU temporary ban has heightened fear among dried-beans marketer and exporters. And the European Union (EU) has extended its ban on importation of dried beans from Nigeria by three years up-to 2019.

The EU members were accusing the Nigerian Government of not doing enough in maintaining the minimum accepted residue limit. The EU observed that the residue levels of pesticides in Nigerian cowpeas is still higher than accepted limit (WHO, 2013), therefore, they believed that compliance with food law requirement as regards pesticide residual in Nigeria cannot be achieved in the short term. Therefore, the duration of the Nigeria's dried-beans importation to EU prohibition should therefore be extended for an additional period of three years to allow Nigeria implement the appropriate risk-management measure and provide further required assurance.

4.2 Dried-Beans Marketing in Nigeria

Most of the bulk beans consignment in Nigeria originates from the Northeast region, specifically from Yobe, Gombe, and Borno states. These dried-beans were mainly cultivated in the rural areas. Though, beans were first exposed to synthetic pesticides since from farms, but that was mainly spread onto their buds which were processed and removed before taking the beans to market. The sale of dried-beans in Nigerian local markets is all year round

activity whether for local consumption or international exportation. This activity is defragmented into two distinct but overlapping phases or activities. For instance, within the northern part of Nigeria, dried-beans are brought to market by local farmers few days to months after harvest (around November/December) to cater for family immediate needs and wants. This is the first phase of dried-beans sales where farmers sales their commodities directly to their respective third party clients in local market for either domestic or storage. Next phase is the sales of these dried-beans marketing from third party to either the domestic clients or export clients. The second phase normally happened after some months of storage of the products which exposes the seeds to various types of insect infestations.

However, between the first and second phases of events, there are two distinct activities; fumigation or mixing the dried-beans with mainly synthetic pesticides to avoid further damages to the commodity, and store it for some time in stores with expectation for better price. This incident of banning of Nigerian dried-beans by EU has caused huge losses to marketers, especially the exporters. There is a need to be proactive in order to avoid further occurrence. Traders from almost all regions (e.g. West; Ibadan (Oyo State), Akure (Ondo State), Lagos (Lagos State), and even within the Northern region; Jibia (Katsina State), and Dawonao in (Kano States) part of the country patronizes the Potiskum grain market.

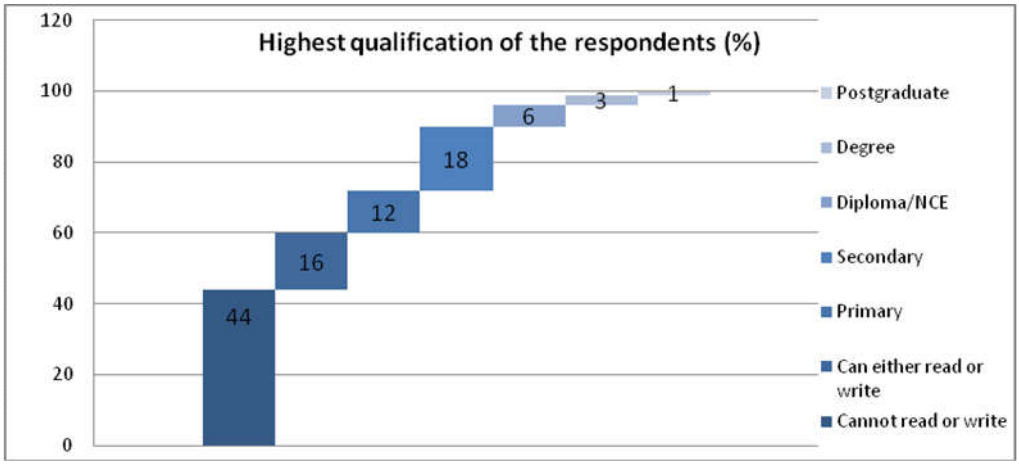
4.3 Potiskum Grain Market as the Hub for Dried-Beans in Nigeria

Based on primary data, Potiskum grain market is for many years a gateway for supplying and transporting assorted dried-beans to the Eastern and Western parts of the country. These transported dried-beans were both for local domestic consumptions and foreign exports. Based on the interviewed conducted to one of the key player in the grain market, Mallam Mohammed Habib Inusa has been in the dried-beans business for over twenty years stated that "*beans business in Potiskum grain market is famous and also a lucrative business as long as the beans is free from insects' infestation*". He further stated that "*the market has metamorphoses to depot and becomes second to none in the whole Northeast region of Nigeria*". Based on Potiskum geographic location and transportation advantages, this market served like deport which holds all year round business activities, and also receives supplies of dried-beans from almost all parts of the North East states.

Potiskum is one of the major frontiers of the heavy transportation industry in Nigeria; the large number of heavy duty trucks has contributed greatly to the development of this grain market. Most merchants go to as far as Gaidam, Gadaka, Ngalda (within the Yobe State);

Gombe, Kumo, Tumu, Mallam-Sidi, Kurugu and Kashere (in Gombe State); Garba Shede and Mutin Daya (Taraba State); and Maiduguri (Borno State) to purchase these products, and then brought the commodity to the Potiskum grain market for onward sales to other states of the country.

The Potiskum grain market operates on daily basis, this study found that the market composition is dominated by male aged from 15 to 70 years. The activities of the market start as early as 7 am in the morning and up to 7pm (closing). The activities within the market were dominated by illiterates males with more than half of them cannot read or write.



***Source**: Based on primary survey, 2017*

Moreover, the study discovered that most of the interviewed respondents were experienced people who spent more than five years in the market. However, information given by these people was mainly based on their experiences.

4.4 Pesticides and their forms of Application on Dried-Beans in Nigeria

This study discovered that only synthetic pesticides are used in protecting the dried-beans from pest and fungi. Cooper and Dobson (2007) maintained that for every dollar spent on pesticide for crop yield and storage four dollars in crops is saved; since 10 billion dollars worth of agro-chemicals is used for crops globally annually then 40 billion worth of crops is saved annually. The most common of these synthetically made pesticides used in local Nigerian markets are the DD Force, Goodbye, Sharp shooter, Fiya-Fiya, etc. These synthetic products are made of dichlorvos, Cyhalothrin, Chlorpyrifos, Trichlorphon, Omethoate and Dimathoate. Moreover, it is a fact that higher levels of these chemicals were discovered in dried-beans originating from Nigeria in the international market (WHO, 2013).

This study further observed that these synthetically pesticides were applied directly unto the dried-beans seed manually, and mixed to ensure through blending. Mixing of the dried-beans with the pesticide mostly happened within the market premises. These pesticides were exposed to open air exposing the health of labourers, merchants, surrounding trees, passerby, storekeepers, consumers, food sellers within the market to great danger. This causes both direct effect and indirect effect on the dried-bean market population, immediate plants as well as the immediate air.

4.5 Unintentional Poisoning of Dried-Beans in Nigeria

The various technologies of crop preservation locally are grossly inadequate and most cases highly expensive in Nigeria. The instruction on synthetic pesticides user manual is never taking into consideration. With the dried-beans urge for maximum profit, adoption of the organic pesticides is the only immediate solution. Since infestation is imminent, the merchant and store keepers tend to adopt precaution measures of applying the synthetic pesticides to avoid any damage that may arise in order to maintain sustainable profit margin. This study discovered that majority of the merchants and marketers actively involved in activities within the grain markets in Nigeria agreed that one of the most deadly challenges they faced is the infestation by insects. However, it is further discovered that dried-beans is the most important cash crop in the markets. Therefore, any infestation toward stored dried-beans can affect the entire market activities. Moreover, this infestation did not only threaten the dried-beans capital, quality, grade, and weight, but can further affect the total welfare of the stakeholders involved and consequently incur great loss among the traders and merchants.

5. Conclusion

The present study investigates the source of toxic found in dried-beans originating from Nigeria. This contamination mostly happened in market in a quest to preserving the dried-beans, the merchants and store keepers tend to apply excessive synthetic pesticides and insecticides. Although the National Environmental Standards Regulation Enforcement Agency (NESREA) is actively involved in ensuring safe use and management of pesticides in Nigeria, but it is evidently clear that there are many pesticides grossly handled wrongly in Nigeria. However, due very low level of education among the various stakeholders actively involved in Nigeria grain markets, control of synthetically made products applied to local grain products is in very early stages. For instance, these synthetic pesticides were grossly

applied and excessively before storage and also not in accordance with the manual compliances. These synthetic products directly leave their residue on the dried-beans, and consequently affect the dried-bean quality as well as its nutritional values. However, both direct and indirect effect of wrong usage of pesticide is dangerous to human health and the environment. In order to avoid this, the government need to impose significant tariff on synthetic pesticides and other related products, and on the other hand, subsidy should be granted to organically processed products and pesticides, for instance, biotechnical products. Thus, biotechnical storage pest control leaves no residue, maintains the quality, safety while extending the finished produce shelf life.

Therefore, this study reaffirm the recommendation of Parbhu *et al.* (2009) of the application of insecticide and pesticides formulated from organic substances, for example; insecticides with plant origin. Since there are several botanicals quasi-experimental studies comparing the synthetic chemical (Actellic super dust) and without insecticides application as controls (Parbhu *et al.*, 2009). Moreover, the Nigerian government should advocate the use of Bionimbecidine HP111 botanical storage chemical by handlers and marketers. Since there are various products from organic plant extracts for post harvesting and storage of grains which leaves no residue, easily biodegradable, and poses no health threat to humans as a panacea. There are need intense and regular informative seminar campaign on organic pesticides and other related products, and also this product should be widely distributed across all regions. Lastly, there is need for regular training of various stake holders about agrochemical products and other related pesticides.

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